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(54) Procedure and apparatus for locating a container for lifting.

(57) Procedure and apparatus for locating a container (15) by the aid of a video device to enable the loading device (1) of a container crane to be moved so that the interlocking means (6) of the graspers (4) of the loading device will be engaged with the corner pieces (16) of the container so as to allow the latter to be lifted. The area below the loading device (1) is observed by means of video devices (7) placed in the vicinity of at least two of the interlocking means (6). Based on the video datas obtained from each video device the loading device is brought in the correct position to the container (15) and the interlocking means (6) of the graspers (4) are fastened.

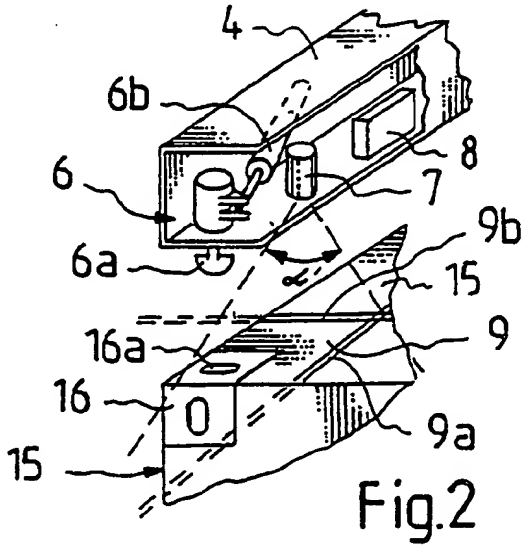

Fig.2

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PROCEDURE AND APPARATUS FOR LOCATING A CONTAINER FOR LIFTING

The present invention relates to a procedure for locating a container for lifting as defined in the introductory part of claim 1. The invention also relates to an apparatus for implementing the procedure.

At ports, railway depots and other places, containers are generally handled using container cranes and/or other container handling equipment, by means of which the containers are lifted and moved from one place to another, e.g. from a ship to the quay or from a railway carriage to the depot area.

A container crane or a similar machine for lifting and moving containers comprises, in addition to the normal lifting and moving apparatus, a loading device for gripping the container, said device being connected to the lifting and moving apparatus by ropes or equivalent. The loading device is provided with graspers for engaging the corner pieces at the upper corners of the container to be lifted or moved.

In current practice, the operator of the container crane locates the container preliminarily for the lifing operation, whereupon, based on visual observation, the loading device is brought to a position about half a metre above the container. The loading device is provided with mechanical stoppers on its sides. When the loading device is being brought closer and closer to the container, the stoppers at its sides are in a low position. When they hit the side of the container, the loading device is directly above it. The graspers of the loading device are now moved longitudinally until they reach the end stoppers. The loading device is now exactly aligned with the corner pieces of the container. When it is lowered onto the container, the interlocking means are automatically inserted into the holes in the corner pieces and interlocked with the latter, whereupon the container can be lifted and moved by the crane.

One of the previously known methods is the arrangement presented in patent publication DE-A 2,642,373, in which the crane is provided with a closed-circuit TV camera mounted on the boom. With the aid of the camera and a monitor, the crane operator is able to observe the lifting operations.

A drawback with the current procedures is that they are based on the operator's abilities and skill. Another drawback is that the operator's ability to quickly and reliably locate the container is affected by external conditions, such as the weather and lighting. A further drawback is that the container may have to be located from a relatively long distance, which diminishes the reliability of the locating procedure.

The object of the invention is to eliminate the drawbacks referred to above.

The procedure of the invention is characterized by what is presented in claim 1. The device of the invention is characterized by what is presented in claim 6.

In the procedure of the invention, the container is located by means of a video device, the loading device of a container crane or an equivalent container handling apparatus is moved and the interlocking means provided in the graspers of the loading device are engaged with the corner pieces of the container to enable the latter to be lifted. The procedure of the invention is characterized in the area below the loading device observed by means of video devices placed in the vicinity of at least two of the interlocking means, and that, based on the video data obtained from each video device, the container, its edges and/or corner pieces are recognized and, by the aid of the video information, the loading device is brought in the correct position to the container and the interlocking means of the graspers are fastened.

In an embodiment of the procedure, the images obtained from the video device are presented via a monitor to the crane operator, who, by the aid of the images, fastens the graspers of the crane to the container.

In an embodiment of the procedure, on the basis of the video information obtained from the video devices, the interlocking means of the graspers are guided automatically into the holes of the corner pieces of the container and fastened to them.

In an embodiment of the procedure, the loading device is provided with a lighting means to illuminate the area below the graspers.

In an embodiment of the procedure, the lighting means is implemented as a laser device, by means of which at least one strip of laser light is produced for each corner of the container brought into the monitoring area of the cameras; and, on the basis of the laser light strips, the edges and corners of the container are located from the pictures obtained from the cameras.

Embodiments of the device of the invention are presented in claims 7 - 10.

The invention provides the advantage that it essentially facilitates the work of the crane operator.

Another advantage provided by the invention is that, making use of the video information obtained from the video devices, the loading device can be guided either manually or automatically.

Furthermore, the invention allows more efficient handling of containers by means of container cranes.

The invention also has the advantage that the containers can be located from a relatively long distance and the loading device can be reliably brought into contact with the container.

A further advantage of the invention is that the procedure and device are simple to implement and require few components.

Moreover, the invention improves industrial safety as it reduces the possibility of human error.

In the following, the invention is described in detail by referring to the appended drawing, in which Fig. 1 shows a diagram representing the loading device of a container crane;
Fig. 2 presents one end of a grasper of the loading device, partially opened and in perspective, and, close to it, a corner of a container;
Fig. 3 presents one end of a grasper of the loading device as seen from above and partially opened, and a corner of a container below it;
Fig. 4 presents a diagram representing the arrangement for image processing and control; and
Fig. 5 presents an image of two corners of a container, produced by two video devices and displayed by one monitor.

Fig. 1 illustrates the loading device 1 of a container crane or an equivalent container handling apparatus. It is attached to the hoisting ropes 2 of the crane (not shown in the drawing). The loading device 1 consists of an elongated frame 3, each end of which is provided with a grasper 4. At the middle of the frame 3 is a grasper setting mechanism 5, to which the ropes 2 are attached. The frame 3 is composed of beam-like parts telescopically connected to each other so that the graspers 4 can be moved in the longitudinal direction of the frame 3. The setting mechanism 5 is mounted on the frame 3, preferably using a rotatable joint. With these arrangements, the graspers 4 of the loading device 1 can be moved longitudinally relative to each other and turned into a desired angle relative to the setting mechanism 5. The interlocking means 6 are placed at the ends of the graspers 4 at each corner of the loading device 1.

Fig. 2 shows one end of a grasper 4, which is provided with an interlocking means 6 having a downward-pointing trunnion 6a and connected to a turning means, i.e. a hydraulic cylinder 6b. In the vicinity of the interlocking means, at a suitable distance from it, is a video device 7 comprising a camera, e.g. a CCD camera or equivalent, and a lens system in conjunction with it.

The video device 7 is directed mainly downwards from the grasper 4. The optical axis of the video device may be perpendicular to the lower surface of the grasper 4, or it may be at an oblique angle towards the trunnion 6a of the interlocking means 6. The angle α of view of the video device 7 is preferably relatively wide, e.g. 55°, to enable the location of the corner 15a of the container 15 in question to be determined in relation to the trunnion 6a of the interlocking means 6 from a close distance.

Arranged in conjunction with the grasper 4 is a laser device 8 comprising at least one laser and a beam spreader, by means of which the laser beam is directed downwards from the grasper 4 in a desired angle and processed in such a way that a strip of laser light 9 is produced on the surface below the grasper 4. The beam spreader is implemented using a suitable lens system. Alternatively, it is possible to use a beam deflector, by means of which the laser beam is deflected in a given angle at a desired frequency.

The grasper 4 is so provided with laser devices 8 that at least one laser light strip 9a oriented in the longitudinal direction of the grasper 4, and a suitable number, at least two, of laser light beams 9b perpendicular to the grasper, are directed at the area below the grasper.

Mounted in conjunction with the lens system of the video device 7 is a band-pass filter preventing the entry into the video device 7 of disturbing radiation of frequencies outside the laser light frequency.

The images obtained from the video device 7 are processed in real time at a suitable frequency using an image processing arrangement as presented in Fig. 4. The loading device 1, especially the graspers 4, are controlled on the basis of the video data obtained from the video devices 7. The video devices 7 are connected to a data processing unit 11, which processes the video data obtained from them in a suitable manner and outputs the video information to a monitor 10. The monitor 10 is preferably placed in the crane operator's 14 working space.

The number of video devices 7 is e.g. one per each grasper 4, and they are placed on the same side of the loading device, e.g. on its longer side near the ends close to the interlocking means 6 e.g. at a distance of 15 cm from them. In this case, the image data is so processed that the images 70, 71 obtained from the video devices are displayed in the same monitor 10, as illustrated by Fig. 5. Thus the crane operator observes the display of only one monitor 10 and controls the loading device 1 on the basis of the information provided by the display.

Alternatively, in processing the image data obtained from the video devices 7, the data processing unit 11 uses a suitable pattern recognition program to recognize the shapes of the laser strips 9a, 9b and performs appropriate calculations to

locate the edges and corners 15a of the containers 15. Based on these data, the lifting and/or lowering mechanism of the loading device 1 as well as the grasper setting mechanism 5 are so controlled by the control logic 12 that the loading device 1 is automatically positioned above the container 15 and the interlocking means 6 engage the corner pieces 16 of the container.

In principle, the above-described apparatus for locating a container works as follows. The operator 14 of the container crane moves the loading device 1 to within a few metres from the container to be lifted. Next, he starts the locating program which, based on the image data obtained from the video devices 7, recognizes the container 15 to be lifted. Beams 9a, 9b of laser light are emitted towards the container from the laser devices 8 in the graspers 4, and the strips of light produced by the beams on the upper structures of the container are observed by the video devices 7. From the images produced by the video devices 7, the data processing system calculates the ending points of the laser strips, i.e. the location of the edges of the container. As the edges are known to be parallel to each other, the positions of the corners 15a of the container can be determined from these data. Based on the information thus obtained, the driving mechanism 13 of the loading device 1 is so controlled via the control logic 12 that the loading device 1 is caused to approach the container 15 in the correct position. Simultaneously, the video information obtained from the video devices 7 is analyzed in the data processing unit 11, observing whether the approaching movement proceeds in the expected manner. After the loading device 1 has reached a position close above the container 15 so that the interlocking means 6 of the graspers 4, especially the trunnions 6a, are immediately above the holes 16a of the corner pieces 16 of the container 15 as illustrated in Figs. 2 and 3, the loading device 1 is lowered directly down onto the container so that the trunnions 6a of the interlocking means 6 are inserted into the holes 16a of the corner pieces 16 of the container, said holes being recognized. After this, an actuating command is sent to the cylinders 6b of the interlocking means 6, whereupon the cylinders turn the trunnions 6a into a position where they are interlocked in the holes 16a of the corner pieces 16. The crane operator is then informed that the lifting can be started. Alternatively, the lifting operation can also be started automatically.

The laser strip may be directed transversely across the corner of the container, in which case a single laser strip instead of two will suffice for each corner of the container.

The invention is not restricted to the embodiment example described above, but instead several variations are possible within the scope of the idea of the invention as defined in the following claims.

Claims

1. Procedure for locating a container by the aid of a video device to enable the loading device (1) of a container crane or an equivalent container handling apparatus to be moved and the interlocking means (6) of the graspers (4) of the loading device to be engaged with the corner pieces (16) of the container (15) so as to allow the latter to be lifted, based on the video data obtained from the video device, in which procedure the container (1), its edges and/ or corner pieces (16) are recognized; and, by the aid of the video information, the loading device (1) is brought in the correct position to the container (15) and the interlocking means (6) of the graspers (4) are fastened. **characterized** in that
the area below the loading device (1) is observed by means of video devices (7) placed in the vicinity of at least two of the interlocking means (6).

2. Procedure according to claim 1, **characterized** in that the images obtained from the video devices (7) are presented via a monitor to the crane operator, who, by the aid of said images, fastens the interlocking means (6) of the graspers (4) to the corner pieces (16) of the container.

3. Procedure according to claim 1, **characterized** in that, based on the video data obtained from the video devices (7), the interlocking means (6) of the graspers (4) are automatically guided into the holes (16a) of the corner pieces (16) of the container and fastened in them.

4. Procedure according to claim 1, 2 or 3, **characterized** in that the loading device (1) is provided with a illuminating means serving to illuminate the area below the graspers (4).

5. Procedure according to claim 4, **characterized** in that the illuminating means consists of a laser device (8) by means of which at least one strip of laser light (9a, 9b) is produced for each corner (15a) of the container (15) brought into the monitoring area of the cameras (7); and, on the basis of the laser light strips (9a, 9b), the edges and corners (15a) of the container (15) are located from the images obtained from the cameras.

6. Apparatus for locating a container to enable the loading device (1) of a container crane or an equivalent container handling apparatus to be moved and the interlocking means (6) of the graspers (4) of the loading device to be engaged with the corner pieces (16) of the container (15) so as to allow the latter to be lifted, said device being provided with video equipment,
comprising a video camera or
an equivalent camera producing a living image;
that the container (15), its edges and/or corner pieces (16) are recognized from the real-time images produced by the cameras and, by the aid of the video information, the loading device (1) is brought in the correct position to the container (15) and the interlocking means (6) of the graspers (4) are fastened, **characterized** in that the loading device (1) is provided with video devices (7) placed in the vicinity of at least two interlocking means (6) and directed essentially downwards.

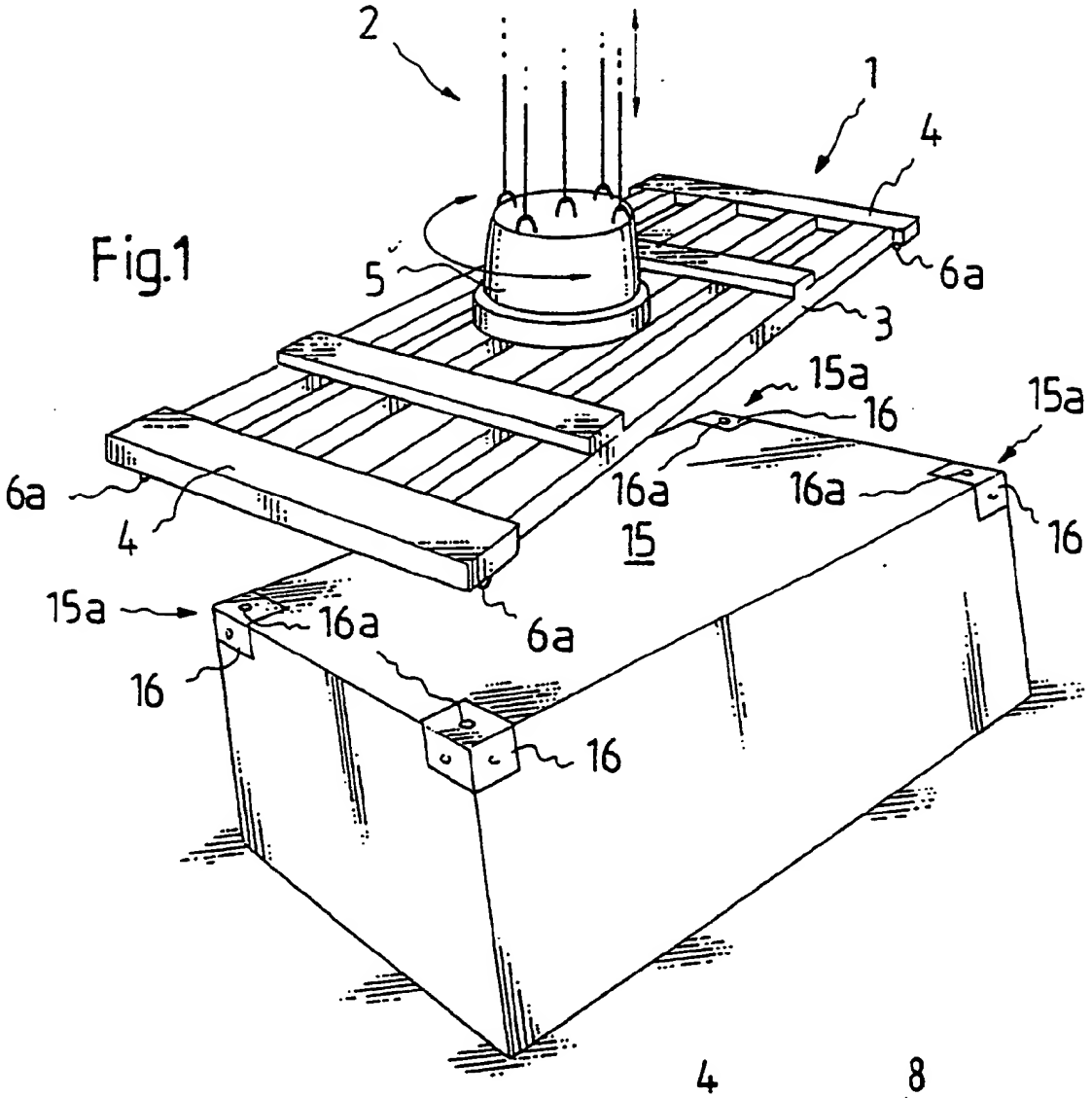
7. Apparatus according to claim 6, **characterized** in that it comprises a monitor (10) by means of which the images obtained from the video devices (7) are presented to the crane operator, who, by the aid of said images, fastens the interlocking means (6) of the graspers (4) to the corner pieces (16) of the container.

8. Apparatus according to claim 6, **characterized** in that it comprises a recognition unit (11) by which the container (15), its edges and/or corner pieces (16) are recognized on the basis of the video data and the interlocking means (6) of the graspers (4) are automatically guided into the holes (16a) of the corner pieces (16) and fastened in them.

9. Apparatus according to claim 6, 7 or 8, **characterized** in that the loading device (1) is provided with at least one illuminating means serving to illuminate the area below the graspers (4).

10. Apparatus according to claim 9, **characterized** in that the illuminating means consists of a laser device (8) by means of which at least one strip of laser light (9a, 9b) is produced for each corner (15a) of the container (15) brought into the monitoring area of the cameras (7), the edges and corners (15a) of the container (15) being located on the basis of the laser light strips (9a, 9b) in the images obtained from the cameras.

Fig.1



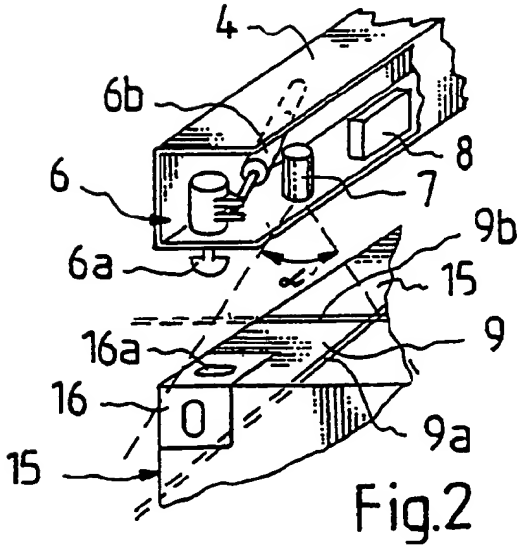


Fig.2

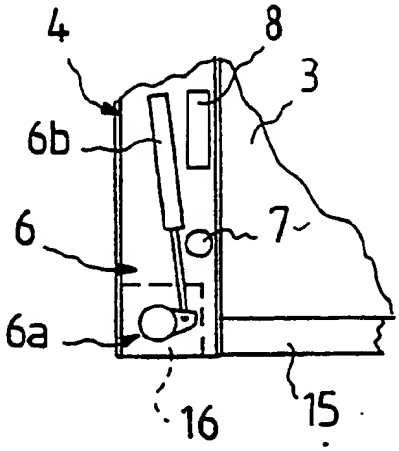


Fig.3

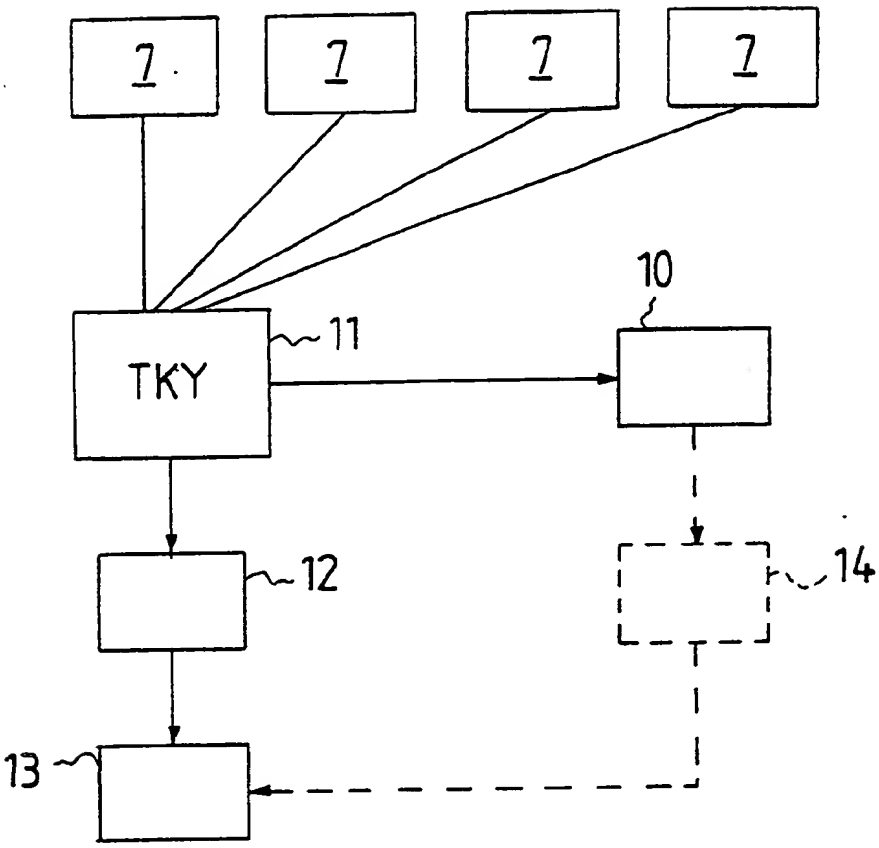


Fig. 4

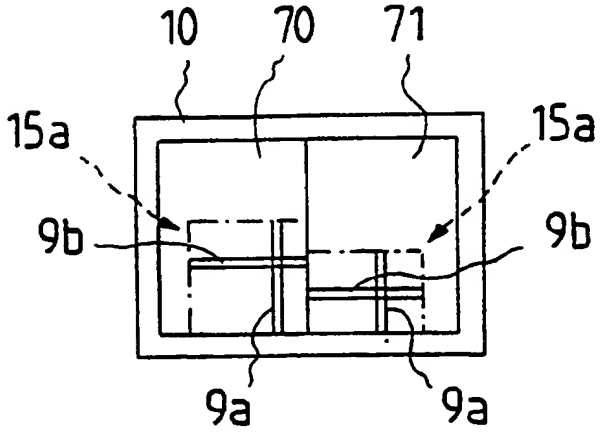


Fig.5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 12 3322

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	FR-A-2 196 288 (CONRAD-STORK) * Page 5, lines 11-31; figures 1,2 *	1-10	B 66 C 13/46 B 66 C 1/66
Y	EP-A-0 342 655 (TAX INGENIEURGESELLSCHAFT) * Column 9, lines 49-58; column 10, lines 50-58; column 11, lines 1-8 *	1-10	
P,A	EP-A-0 347 784 (OUTOKUMPU OY) * Complete document *	1,2,3,6,7, 8	
A	EP-A-0 254 192 (T.E.C. COMPUTER)		
A	DE-A-2 746 794 (HITACHI)		
A	GB-A-2 099 255 (U.K. ATOMIC ENERGY AUTHORITY)		
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D,A	DE-A-2 642 373 (ZWAGERMAN)		
A	DE-U-8 417 164 (ASMUS)		
A	US-A-4 245 271 (GWIN)		
A	GB-A-2 113 179 (COLTMAN)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 66 C
B 66 F

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	22 January 91	VAN DEN BERGHE E.J.J

CATEGORY OF CITED DOCUMENTS

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